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AUTHOR Abou-Sayf, Frank K.
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ABSTRACT

At a community college in Hawaii, two separate validation processes were carried out in order to install a new student placement test, each serving a different purpose at different times in the installation process. Decision Theory was used to arrive at a decision tool to allow for compromises between accuracy and enrollment management. The American College Testing Program's COMPASS test was chosen as the placement test for English and mathematics. A linear regression equation, based on responses of 400 students, was generated for each COMPASS test to allow the conversion of current placement scores to COMPASS scores to permit a smooth transition in test use. Because the new test replicated the supposed accuracy of the old test, validity was studied with the Decision Theory approach. An alternative approach used to solve some of the validation dilemmas consisted of using instructors' opinions about the correctness of student placement in their courses at the beginning of the semester. However, this approach proved to be of little use. (SLD)

How To Install A New Placement Test: Methodology and Results at a Two-Year Institution

Frank K. Abou-Sayf

Director, Planning and Institutional Research

Kapiolani Community College
Honolulu, Hawaii

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Introduction

About four years ago, this college decided to use the American College Testing (ACT) Service's COMPASS as its placement test for both English and math. Various steps were needed to install this computer-based test on campus in a manner that (a) does not initially disturb the prevailing course population significantly and (b) ultimately leads to improved accuracy in placing students.

Methodology

Although validation data were provided by ACT, it was decided that this college will generate its own validation data instead of using ACT's data. The following steps were taken for the installation of a new placement test:

1. **Initial Validation: Maintaining the Status Quo**

   Initially, a campus wanting to validate locally a new placement test is typically faced with the lack of data to determine optimal cut-off scores. One method that can be used to generate temporary data that has been used at this college is based on the principle of maintaining the same course population as the one that exists with the current test. To accomplish this, COMPASS was administered to a random sample of new enrollees who had taken the current placement test only a few weeks earlier. Based on 460 students, a simple linear regression equation was then generated for each COMPASS sub-test. For this college and for the Reading sub-test, for example, it was:

   $y = 24.0576 + 4.1420\,x$, where y is the COMPASS score, and
   x is the score on the current test (the Nelson-Denny).

   Once derived, this set of equations allow the conversion of the current placement scores to the COMPASS scores and allows for a smooth transition from the current placement test to the new placement test with little or no shift in course population.

   The problem inherent in this approach is that, theoretically, the new test replicates the same accuracy level that the current placement test has. In case of this college, the accuracy of the Nelson-Denny had never been studied. Yet, it was expected that the use of equivalent cut-off scores on COMPASS would not improve placement accuracy, which did not allow the college to realize one of the initial incentives to adopt COMPASS.

2. Second Validation: Cut-Off Score Revision

The second validation process should be carried out after allowing time to generate enough data for a more encompassing study. The methodology involved in this phase relied heavily on correlation and regression techniques, using the final grade on the first English or math course immediately following the placement as the dependent variable. The methodology consists of two separate steps, the first is the calculation of validity measures, and the second one is to generate new cut-off points.

A. Validation: The Use of Logistic Regression

Because the dependent variable, namely success in the particular course in which the student was placed, is dichotomous (pass or fail outcomes only), logistic regression was conducted to calculate validity. The results of the regression for this college are shown in Table 1.

Table 1
COMPASS Logistic Regression Analysis Results
p-Value for Wald Statistic
(Sample Size)

Course	Reading	Writing		
Eng A	0.0496 *	0.0009 *		
	(131)	(132)		
Eng B	0.5086	0.1150		
	(171)	(171)		
Eng C	0.9814	0.0014 *		
	(413)	(413)		
Eng D	0.9755	0.2546		
	(565)	(565)		
Eng E	0.3134	0.9456		
	(31)	(30)		
Course	Pre-Alg	Alg	Coll Alg	Trig
Math A	0.1847	0.2959	x	x
	(397)	(48)		
Math B	0.0000 *	0.0006 *	x	x
	(412)	(353)		
Math C	0.0159 *	0.0036 *	x	x
	(215)	(224)		
Math D	0.2637	0.0685 *	x	x
	(17)	(22)		

* Statistically significant measure

The data indicated that:

1. Math was a better predictor of subsequent math course performance than English was for subsequent English courses.
2. The validity of the sub-tests making up the English and math tests was quite varied. In general, writing was a better predictor of performance in English courses than reading, and pre-Algebra and Algebra were better predictors of their corresponding courses than were College Algebra and Trigonometry (not shown in the table for other Math courses). The superior predictive ability of writing over reading supports the practice at several higher-education institutions where writing samples are used to place students (Schum, 1985).

Table 2
Course-Specific Decision Analysis
for COMPASS Cutoff-Score Determination*

States of Nature *		
Decision Alternatives	**Success in Course**	**No Success in Course**
Admit	A	B
Do Not Admit	C	D

Statistical Indices

For each COMPASS score in each course, the following three indices were calculated:

Percent Not Admitted = $(C+D)/(A+B+C+D)x100$

Accuracy Rate = $(A+D)/(A+B+C+D)$

Success Rate = $A/(A+B)$

** Adapted from Noble and Sawyer (1997)*
*** Situations not under the control of the decision maker*

B. New Cut-Off Score Derivation: The Use of Decision Theory

In addition to logistic regression, Decision Theory was used for the calculation of 3 rates: accuracy rates, success rates, and enrollment rates. The formulas to calculate these indices are presented in Table 2, and the results in Table 3. Table 3 shows the example of one math course and one COMPASS sub-test. In this table, the framed number indicates the current cut-off. A similar set of calculations needs to be derived for each course and sub-test used for placement purposes.

The data in Table 3 provide a powerful decision-making tool which allows for compromises between rigid statistical decisions and enrollment-management considerations.

Table 3
Placement Results for Math C - Pre-Algebra Sub-test Scores

COMPASS Score	% Not Admit	Accuracy Rate	Success Rate
23	2.44	0.30	0.40
24	4.88	0.47	0.47
30	9.76	0.40	0.50
33	12.20	0.43	0.53
35	14.63	0.39	0.49
36	17.07	0.45	0.45
38	24.39	0.48	0.48
39	29.27	0.51	0.51
40	31.71	0.56	0.56
44	34.15	0.53	0.53
50	39.02	0.55	0.55
51	43.90	0.57	0.57
52	48.78	0.58	0.58
54	51.22	0.56	0.56
55	58.54	0.56	0.56
56	60.98	0.55	0.59
59	63.41	0.53	0.63
61	65.85	0.52	0.62
62	75.61	0.48	0.68
70	78.05	0.40	0.70
72	80.49	0.32	0.72
76	82.93	0.34	0.74
79	85.37	0.33	0.73
81	90.24	0.34	0.79
85	92.68	0.36	0.86
89	95.12	0.35	0.85
91	97.56	0.37	0.87

C. Limitations

In studies of this type, the following dilemmas are usually encountered:

1. The calculation of predictive validity of placement tests when final course grades are used as the dependent variable is conceptually flawed, since placement test scores are designed to place students in the beginning of a course. Inherent in this approach is the incorrect assumption that a student who places correctly in a certain course is expected to pass this course. Thus, extraneous emotional, family- or job-related factors are not considered (Abou-Sayf, 2000A).

2. Grades are inherently poor as criterion variables.

3. In multi-campus districts or systems such as this one, articulation imposes the use of uniform cut-offs for all campuses, regardless of the difference in ability of the applicants.

Alternative Validation Measures

As an alternative to using final grades as the dependent variable, instructors' opinion about whether each student in their class has been appropriately placed based on their knowledge of the student's ability was sought early on in the semester (Abou-Sayf, 2000B). The use of surveys to validate placement test results is not novel. Armstrong and Takahata (1991), for example, used results of faculty and students' opinions on the accuracy of the test as the dependent variable. In this study, data on 2,856 students in 15 courses, 5 English and 10 Math courses, were obtained from the instructors and correlated with placement tests. The resulting phi coefficients are presented in Table 4 and indicate that there was a low agreement between the placement test results and the instructors' evaluation of the adequacy of the student's placement. The results also indicate that agreement between these two measures was even weaker at the lower-level classes than at the higher ones.

Table 4
COMPASS Phi Coefficients

English			Math		
Course	Correlation Coefficient Phi	n	Course	Correlation Coefficient Phi	n
All	0.205489329	570	All	0.399969282	858
Eng A	0.149786172	61	Math A	0.384514959	40
Eng B	0.137940147	87	Math B	0.355473344	151
Eng C	0.324698847	120	Math C	0.421350486	170
Eng D	0.185511996	302	Math D	0.289157466	36
			Math E	0.396964883	285
			Math F	0.262346929	60
			Math G	0.452620765	81
			Math H	0.471404521	20
			Math I	0.480384461	15

Another alternative to the use of final exam grades as the dependent variable would be to use the scores on a competency-based exam to all students that would be administered at the very beginning of the course. more research is needed in this area.

Summary and Conclusions

At this college, two separate validation processes were carried out in order to install a new placement, each serving a different purpose at a different point in the installation process. Decision Theory was used to arrive at a decision tool that allows for compromises between accuracy and enrollment management. An alternative approach used to solve some of the validation dilemmas

and consisting of using instructors' opinion about the correctness of student placement in their courses at the beginning of the semester proved to be of little use.

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